

Appl. No.: 10/530,271
Amdt. Dated November 24, 2008
Reply to Office Action of August 22, 2008

In the Claims

This listing of claims replaces all prior versions and listings of claims:

1. (Currently Amended) A complementary type magnetic storage device for storing to store contrary data contrary to each other in a first ferromagnetic tunnel junction element and a second ferromagnetic tunnel junction element, respectively, said magnetic storage device comprising:

a semiconductor substrate with said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element formed adjacently thereon, each of said first and second ferromagnetic tunnel elements having a fixed magnetic layer and a variable magnetic layer;

a first writing lines-line wound around said first ferromagnetic tunnel junction element in a coil configuration that extends in a first direction; and

a second writing lines-line wound around said second ferromagnetic tunnel junction element in a coil configuration that extends in a second direction opposite to the first direction;
wherein,

said first writing lines-line and said second writing lines-line are wound reversed with respect to each other.

2. (Currently Amended) The magnetic storage device of claim 1, further comprising:

a start-end portion of said second writing lines-line connected to a terminal-end portion of said first writing lines-line to be a sequence of writing lines.

3. (Currently Amended) The magnetic storage device of claim 1, wherein:

said first writing lines-line and said second writing lines-line have parallel wiring portions extending in a direction parallel to a magnetization direction of the fixed magnetization layers at positions immediately above or immediately below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element.

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4. (Currently Amended) The magnetic storage device of claim 1, wherein:

 said first writing lines-line and said second writing lines-line have upper and lower writing lines extending in a direction perpendicular to a magnetization direction of said fixed magnetization layers of said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element, at positions above and below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element; and

 at least one of said upper and lower writing lines comprises a parallel wiring portion extending in a direction parallel to a the magnetization direction of said fixed magnetization layers at positions immediately above or immediately below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element.

5. (Currently Amended) The magnetic storage device of claim 2, wherein:

 said first writing lines-line and said second writing lines-line comprising comprise parallel wiring portions extending in a direction parallel to a magnetization direction of the fixed magnetization layers at positions immediately above or immediately below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element.

6. (Currently Amended) The magnetic storage device of claim 2, wherein:

 said first writing lines-line and said second writing lines-line comprise upper and lower writing lines extending in a direction perpendicular to a magnetization direction of said fixed magnetization layers of said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element, at positions above and below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element; and

 said upper and lower writing lines extend in a direction parallel to a magnetization direction of said fixed magnetization layers at positions immediately above or immediately below said first ferromagnetic tunnel junction element and said second ferromagnetic tunnel junction element.

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7. (Currently Amended) A magnetic storage device for storing data in configurations contrary to each other, said magnetic storage device comprising:

a first ferromagnetic tunnel junction element and a second ferromagnetic tunnel junction element adjacently positioned on a semiconductor substrate and extending parallel to each other;

a first writing line coiled around said first ferromagnetic tunnel junction element, the first writing line having in a first orientation direction; and

a second writing line coiled around said second ferromagnetic tunnel junction element, the second writing line having in a second orientation direction that is different than opposite the first orientation direction,

wherein the first writing line and second writing line are connected to each other in series.

8. (Cancelled)

9. (Cancelled)

10. (Currently Amended) The magnetic storage device according to claim 7, wherein the first orientation of the first writing line and the second orientation of the second writing line is such that a first direction of generates a first magnetic force in a first magnetic force direction generated when storage data is written in the first ferromagnetic tunnel junction element is different than a second direction of and the second writing line generates a second magnetic force in a second magnetic force direction different than the first magnetic force direction generated when storage data is written in the second ferromagnetic tunnel junction element.

11. (Cancelled)

12. (Currently Amended) The magnetic storage device according to claim 7, further comprising:

a closed loop formed by the first ferromagnetic tunnel junction element and the second

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ferromagnetic tunnel junction element having a writing direction along the first writing line opposite to the writing direction along the second writing line.

13. (Withdrawn) A method of manufacturing a magnetic storage device for storing data in configurations contrary to each other, the method comprising:

forming a first ferromagnetic tunnel junction element and a second ferromagnetic tunnel junction element adjacently on a semiconductor;

winding a first writing line around said first ferromagnetic tunnel junction element in a first direction; and

winding a second writing line around said second ferromagnetic tunnel junction element in a second direction that is different than the first direction so that data is stored in opposite directions along the first writing line and the second writing line.

14. (New) The magnetic storage device of claim 1, wherein first and second writing lines are connected together in series.

15. (New) The magnetic storage device of claim 1, further comprising:

a start-end portion of said first writing line adjacent to a front end of said first ferromagnetic tunnel junction element and a terminal-end portion of said first writing line adjacent to a back end of said first ferromagnetic tunnel junction element; and

a start-end portion of said second writing line adjacent to a back end of said second ferromagnetic tunnel junction element and a terminal-end portion of said second writing line adjacent to a front end of said second ferromagnetic tunnel junction element.

16. (New) The magnetic storage device of claim 15, wherein,

said first writing line and second writing line are connected to each other such that a current enters and passes through said first writing line in a first direction relative to said ferromagnetic tunnel junction elements and said current enters and passes through said second writing line in second direction opposite to said first direction.

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17. (New) The magnetic storage device of claim 16, wherein,
said first direction is from said front end of said first ferromagnetic tunnel junction
element to said back end of said first ferromagnetic tunnel junction element, and
said second direction is from said back end of said second ferromagnetic tunnel junction
element to said front end of said second ferromagnetic tunnel junction element.

18. (New) The magnetic storage device of claim 14, wherein said first writing line
terminal-end portion is nearer said second writing line start-end portion than said second writing
line terminal-end portion.